Alaska Department of Fish and Game
Division of Wildlife Conservation
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Furbearer Management Technique Development

Howard N. Golden

Final **Research** Performance Report
1 July 1995–30 June 2001
Federal Aid in Wildlife Restoration
W-24-3 to 5 and W-27-1 to 4
Study 7.18

FEDERAL AID
RESEARCH FINAL REPORT

PROJECT TITLE: Furbearer Management Technique Development
AUTHOR: Howard N. Golden

COOPERATORS: Merav Ben-David, University of Wyoming; Pamela Groves, University of Alaska, Fairbanks; Brad Shults, National Park Service; Nikolina Guldager, National Park Service; Robert Skinner, U.S. Fish and Wildlife Service; Michael Anthony, USGS Biological Resource Division; Theodore Bailey, U.S. Fish and Wildlife Service; Susan Howell, USDA Forest Service
GRANT AND SEGMENT NR.: W-24-3, W-24-4, W-24-5, W-27-1, W-27-2, W-27-3, W-27-4
PROJECT NR.: 7.18
WORK LOCATION: Unit 13, Unit 6, Units 7 & 15
STATE: Alaska

PERIOD: January 1, 1995–June 30, 2001

I. SUMMARY

Job 1: Distribution and trend of marten, lynx, and snowshoe hare populations. We revised our plan to establish a system of setting up aerial transects to count tracks in snow of lynx, marten, and snowshoe hares. We began tests on the use of a gps-linked computer program in conjunction with digital video cameras to record tracks along a set of systematically placed 3- to 5-km-long linear transects across a variety of terrain and vegetation types. This system is designed to record animals or tracks on digital videotape from the belly of an aircraft. Images can then be viewed on a computer monitor for identification of the animals, their tracks, and vegetation types. The entire system is linked with the GPS system of the aircraft. During 20–24 February, we collaborated on a field project to test the digital video system for recording tracks under actual sampling conditions in Yukon-Charley National Park.

Job 2: Densities, trend, and harvest potential of wolverine populations. We captured 22 wolverines (9 females, 13 males) in the Talkeetna Mountains study area. Mean ages of wolverines at capture were 1.6 years for females (s = 0.7 year) and 2.2 years for males (s = 1.1 years). Mean ages when animals were lost or died were 2.8 years for females (s = 1.5 years) and 2.6 years for males (s = 1.5 years). Home range sizes varied widely, 172–739 km^2 for females and 53–662 km^2 for males. We observed both sexes mainly in the foothills and lower- to mid-elevation slopes (760–1770 m) between the crest of the Talkeetna Mountains to the west and the lake flats of the Nelchina Basin to the east. Modified Kaplan-Meier survival rates (± SD) of all radiocollared wolverines in the Talkeetna Mountains averaged 0.89 ± 0.06 annually. The estimated sustainable yield of female wolverines was 4.40 for the expected level and -0.35 and 16.11 for the lower and upper levels, respectively. Lambda was estimated at 1.19 for an 11,500-km^2 area. The estimated sustainable harvested for the entire population was approximately 14 wolverines.

Job 3: Distribution, trend, habitat use, and harvest potential of coastal river otter populations. We captured 4 river otter (2 females, 2 males) on the south side of Kachemak Bay in 1995 and surgically implanted radio transmitters into their abdomens. Females seemed to restrict their movements to Tutka Bay, whereas the males ranged over a larger area. We searched for and sampled river otter latrine sites along the shoreline in Kachemak Bay. Although there was no observed trend in the scat deposition rate over time in 1995, there was a highly significant decline ($R^2 = 0.99$; $F_{1,2} = 450$; $P = 0.002$) in scats/day between sampling periods in 1996. Scat deposition rates among 3-day samples in 1996 declined gradually over the summer but not significantly ($R = 0.69$; $F_{1,3} = 6.72$; $P = 0.08$). Habitat analysis indicated latrine sites had more shallow vegetated slopes and more bedrock in the intertidal substrate than random sites. We identified 38 unique food items among 90 river otter scats sampled in Kachemak Bay in 1995, and saffron cod, flatfish, rock sole, gunnels, and sculpins composed nearly 40% of those items. In 1996 the most prevalent families of fish found in scat for 8-cm fish were salmons, gunnels, flatfishes, and sticklebacks; for 8–15-cm fish were gunnels, codfishes, sandlances, and sculpins; and for >8-cm fish were flatfishes, sculpins, salmons, and greenlings. We collaborated with researchers at the University of Alaska Fairbanks to analyze river otter scat for DNA microsatellites to estimate river otter density and use of latrine sites by individual animals. We sampled river otter scats among 94 latrine sites in western Prince William Sound for this collaboration.

Job 4: Applying the lynx tracking harvest strategy through rule-based modeling. A rule-based model was developed to aid lynx harvest managers in deciding the most appropriate seasons for lynx trapping under the tracking harvest strategy, which applies to the road-connected areas of southcentral Alaska.

II. CUMULATIVE PROGRESS ON PROJECT OBJECTIVES

JOB 1: DISTRIBUTION AND TREND OF MARTEN, LYNX, AND SNOWSHOE HARE POPULATIONS

OBJECTIVE 1.1: To design ground and aerial track-count procedures to reliably estimate the distribution and trend of marten, lynx, and snowshoe hare populations.

We attempted to simplify aerial track count procedures through the development of a more automated system. We developed a GIS program to establish transects. Recent work has focused on using a GPS-liked digital video system to record tracks in snow along predetermined transects.

OBJECTIVE 1.2: To measure of track-count bias due to track sightability and identification, and design procedures to minimize those biases.

Progress on this objective was limited to planning and initial field tests related to the digital video system described above.

JOB 2: DENSITIES, TREND, AND HARVEST POTENTIAL OF WOLVERINE POPULATIONS

OBJECTIVE 2.1: To assess the accuracy and relative precision of wolverine density estimates derived from line-intercept and network sampling techniques.

Determining the accuracy of the sample-unit probability estimate (SUPE) procedures to calculate wolverine density was not achieved. Early attempts to use radiocollared animals in the Talkeetna Mountains to measure the number of wolverines missed during SUPE flights were unsuccessful in achieving the needed sample size. Later attempts using replicate flights of the same SUPE area in the Talkeetna Mountains and Baird Mountains were unsuccessful due to repeatedly unfavorable snow and weather conditions. Consequently, comparative analyses between the SUPE and transect-intercept probability sampling (TIPS) were not conducted.

OBJECTIVE 2.2: To estimate the densities and trends of wolverine populations in different areas of Southcentral Alaska.

Time, funding, and snow conditions only allowed us to estimate wolverine density with a partial TIPS survey in the Talkeetna Mountains and with a SUPE on a portion of the Kenai Peninsula. More extensive SUPE and TIPS procedures were not conducted for the reasons given in 2.1 above.

OBJECTIVE 2.3: To determine if relationships exist between trends in wolverine density and trends in wolverine harvest, food availability, and abundance of large predators.

We examined wolverine harvest through trapping records and the fate of radiocollared animals. During the latter 2 years of the study, we began to explore habitat relationships through wolverine movement data and GIS analysis.

OBJECTIVE 2.4: To estimate sustainable harvest levels of wolverine populations in Southcentral Alaska.

We estimated wolverine survival based on our radiocollared animals through the use of a modified Kaplan-Meir procedure. We estimated sustainable yield for the Talkeetna Mountains population with a variation of a Leslie matrix model.

JOB 3: DISTRIBUTION, TREND, HABITAT USE, AND HARVEST POTENTIAL OF COASTAL RIVER OTTER POPULATIONS

Objective 3.1: To determine if latrine site use and fecal deposition rates are precise indicators of river otter abundance in coastal areas of Southcentral Alaska.

We identified and sampled latrine sites in Kachemak Bay on the Kenai Peninsula and in several areas of western Prince William Sound. We measured the distribution, density, and relative use levels for latrine sites. Use was based on the presence and relative abundance of river otter scats. We collaborated in research to estimate river otter density using a mark-recapture technique involving the identification of individual otters from DNA in scat.

OBJECTIVE 3.2: To determine which habitat features are most important in defining coastal river otter habitat.

While examining latrine site use by river otter, we measured several habitat features determined to be of importance to river otters. We estimated habitat features common to latrine sites relative to available habitat.

OBJECTIVE 3.3: To evaluate food habits of river otters relative to habitat types and geographic area.

River otter scats were collected from latrine sites in Kachemak Bay. They were sent to a laboratory and analyzed to determine the species and sizes of food items important to river otters.

OBJECTIVE 3.4: To estimate sustainable harvest levels of river otter populations in coastal environments of Southcentral Alaska.

We examined harvest levels and patterns for coastal river otters in southcentral Alaska, but we did not estimate sustainable harvest levels due to delays in estimating otter densities.

JOB 4: APPLYING THE LYNX TRACKING HARVEST STRATEGY THROUGH RULE-BASED MODELING

OBJECTIVE 4.1: To construct a prototype rule-based model for lynx management as part of the decision-making process in the tracking harvest strategy.

A prototype model was developed and used as the foundation for an expanded working model.

OBJECTIVE 4.2: To revise and refine the lynx management model after field testing and user evaluation into a useful tool for wildlife managers.

A full working model was completed and the results published. Revisions and modifications occurred annually.

JOB 5: PREPARATION OF REPORTS AND PUBLICATIONS

One manuscript was published as a book chapter, 2 manuscripts are in review for publication in journals, 2 manuscripts are in preparation for submittal to journals, several oral and poster papers were presented at professional conferences, and 2 web pages were prepared for the ADF&G web site.

II. WORK NOT ACCOMPLISHED AS CONTRACTED:

Track count tests and tests of bias among observers were not conducted.

Wolverine density estimation tests to determine accuracy of the SUPE and to compare it with the TIPS were not accomplished.

River otter estimates of harvest potential were not attempted.

III. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN THIS PERIOD JOB 1: DISTRIBUTION AND TREND OF MARTEN, LYNX, AND SNOWSHOE HARE POPULATIONS

JOB 1.1: Design of ground and aerial track-count procedures.

We focused on the design and testing of a system to record animals or tracks on digital videotape from the belly of an aircraft. Images can then be viewed on a computer monitor for identification of the animals, their tracks, and vegetation types. The entire system is linked with the GPS system of the aircraft. During 20–24 February, we collaborated on a field project to test the digital video system for recording tracks under actual sampling conditions in Yukon-Charley National Park.

JOB 2: DENSITIES, TREND, AND HARVEST POTENTIAL OF WOLVERINE POPULATIONS

JOB 2.1: Tests of wolverine density-estimation techniques.

We made preparations to conduct SUPE tests in the Talkeetna Mountains, Chugach Mountains, southern Alaska Range, or Baird Mountains. However, weather and snow conditions, as well as inadequate funding, did not allow the tests to proceed.

JOB 2.2: Wolverine density and trend counts.

This job was not addressed during this performance period.

JOB 2.3: Wolverine harvest and habitat relationships.

We analyzed wolverine radio location data relative to available habitat in the Talkeetna Mountains. We use field based GPS location data combined with GIS habitat and topographic coverages to test hypotheses regarding sex- and age-specific spatial use patterns and multi-scale habitat selection for radio-collared wolverines in the Talkeetna Mountains.

JOB 2.4: Wolverine population model.

This job was not addressed during this performance period.

JOB 3: DISTRIBUTION, TREND, HABITAT USE, AND HARVEST POTENTIAL OF COASTAL RIVER OTTER POPULATIONS

JOB 3.1: Latrine site use and fecal deposition rates by river otters.

We sampled 35 latrine sites in Kachemak Bay during 12–13 August 2000. We collected all fresh scats at each site on 12 August and marked all older scats with colored glitter. We again collected all fresh scats on 13 August. Fresh scats were preserved in ethyl alcohol for later DNA analysis.

JOB 3.2: Habitat selection and movements by river otters.

This job was not addressed during this performance period.

JOB 3.3: Food habits of river otters among habitat types.

This job was not addressed during this performance period.

JOB 4: APPLYING THE LYNX TRACKING HARVEST STRATEGY THROUGH RULE-BASED MODELING

JOB 4.2: Revision and refinement of a lynx management model.

Lynx carcasses were purchased from trappers in Units, 7, 13, and 15. Reproductive data were analyzed for use in the lynx management model. Minor revisions were made to the model. Management applications were run for areas in southcentral Alaska subject to the trracking harvest strategy for lynx.

JOB 5: PREPARATION OF REPORTS AND PUBLICATIONS

MANUSCRIPTS:

Golden, H. N., B. S. Shults, and K. E. Kunkel *In review*. Immobilization of wolverines with Telazol® from a helicopter. Wildlife Society Bulletin 000:000–000.

Golden, H. N., and K. S. White *In Preparation*. Wolverine (*Gulo gulo*) spatial use patterns and habitat selection in the Talkeetna Mountains, Alaska. Journal of Mammalogy 000:000–000.

Golden, H. N., and M. Ben-David. *In preparation*. Monitoring river otter latrines as an index of population trends: is it a viable tool? Journal of Mammalogy 000:000–000.

POSTER PRESENTATION:

White, K. S., and H. N. Golden. 2001. Wolverine (*Gulo gulo*) spatial use patterns and habitat selection in the Talkeetna Mountains, Alaska. Proceedings of the Annual Meeting of the American Society of Mammalogists, Missoula, Montana, USA.

IV. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THIS SEGMENT PERIOD:

None.

V. RESEARCH RESULTS

JOB 1: DISTRIBUTION AND TREND OF MARTEN, LYNX, AND SNOWSHOE HARE POPULATIONS

We revised our plan to establish a system of setting up aerial transects to count tracks in snow of lynx, marten, and snowshoe hares. We began tests on the use of a gps-linked computer program in conjunction with digital video cameras to record tracks along a set of systematically placed 3- to 5-km-long linear transects across a variety of terrain and vegetation types. Transect endpoints are GPS coordinates that will allow aircraft pilots to follow the route more easily than flying between geographic features (Golden 1987, Golden 1988). The camera system has been used by M Anthony at USGS-BRD in Anchorage (pers commun) on sea ducks and on moose. This system is designed to record animals or tracks on digital videotape from the belly of an aircraft. Images can then be viewed on a computer monitor for identification of the animals, their tracks, and vegetation types. The entire system is linked with the GPS system of the aircraft. During 20–24 February, we collaborated on a field project to test the digital video system for recording tracks under actual sampling conditions in Yukon-Charley National Park.

JOB 2: DENSITIES, TREND, AND HARVEST POTENTIAL OF WOLVERINE POPULATIONS

Of the 22 wolverines (9 females, 13 males) captured in this study, none are currently radiocollared. We know of 11 study animals that have died. Harvest by hunters or trappers accounted for the loss of 9 animals, 7 within and 2 outside the Talkeetna Mountains study area. Mean ages of wolverines at capture were 1.6 years for females (s = 0.7 year) and 2.2

years for males (s = 1.1 years). Mean ages when animals were lost or died were 2.8 years for females (s = 1.5 years) and 2.6 years for males (s = 1.5 years). The oldest wolverines were a 5.5-year-old female (TF1) and a 5-year-old male (TM5). Home range sizes varied widely, 172–739 km^2 for females and 53–662 km^2 for males, but ranges of males ($\bar{x}$ =486 km^2, s = 228 km^2) were not significantly larger than those of females ($\bar{x}$ = 417 km^2, s = 208 km^2) (t = 0.564, P = 0.584, df = 11). We observed both sexes mainly in the foothills and lower- to mid-elevation slopes (760–1770 m) between the crest of the Talkeetna Mountains to the west and the lake flats of the Nelchina Basin to the east. Modified Kaplan-Meier survival rates (± SD) of all radiocollared wolverines in the Talkeetna Mountains averaged 0.89 ± 0.06 annually. Our estimates did not indicate differences in survival between females ($\bar{x}$ = 0.95 ± 0.06) and males ($\bar{x}$ = 0.85 ± 0.08) (χ^2 = 0.063, df = 1, P > 0.10) nor between wolverines first captured as adults (>2 years old) ($\bar{x}$ = 0.84 ± 0.07) and those first captured as yearlings (1–2 years old) ($\bar{x}$ = 0.90 ± 0.08) (χ^2 = 1.619, df = 1, P > 0.10). The estimated sustainable yield of female wolverines was 4.40 for the expected level and -0.35 and 16.11 for the lower and upper levels, respectively. Lambda was estimated at 1.19 for an 11,500-km^2 area. Assuming an even sex ratio, the expected annual yield of female and male wolverines for a population of 54 should be approximately 9. Because this estimate is for a harvested population, it should be considered in addition to the average annual harvest of 4.9 wolverines in GMU 13A for 1984–1998. Therefore, the estimated sustainable harvested for the entire population was approximately 14 wolverines.

JOB 3: DISTRIBUTION, TREND, HABITAT USE, AND HARVEST POTENTIAL OF COASTAL RIVER OTTER POPULATIONS

We captured 4 river otter (2 females, 2 males) on the south side of Kachemak Bay in 1995 and surgically implanted radio transmitters into their abdomens. Telemetry data indicated the 2 female river otters seemed to restrict their movements to Tutka Bay, whereas the males ranged over a larger area. We searched for and sampled river otter latrine sites along the shoreline in Kachemak Bay. Although there was no observed trend in the scat deposition rate over time in 1995, there was a highly significant decline (R^2 = 0.99; $F_{1,2}$ = 450; P = 0.002) in scats/day between sampling periods in 1996. Scat deposition rates among 3-day samples in 1996 declined gradually over the summer but not significantly (R = 0.69; $F_{1,3}$ = 6.72; P = 0.08). Exploratory data analysis through median polish indicated few effects from differences among latrine sites of scat deposition rates (i.e., scats deposited/day). Effects from differences among sampling-period estimates reflected the strong decline in the scat deposition rates for the 3-week interval but no variation in rates among the 3-day intervals. We assessed the habitat of 58 latrine sites and 293 random sites along approximately 107 km of shoreline between Sadie Cove and Kasitsna Bay on the south side of Kachemak Bay. Summary statistics indicated latrine sites had more shallow vegetated slopes and more bedrock in the intertidal substrate than random sites. We identified 38 unique food items among 90 river otter scats sampled in Kachemak Bay in 1995. Saffron cod, flatfish, rock sole, gunnels, and sculpins composed nearly 40% of the items identified among 38 latrine sites. Thirty of the food items were bony fishes. The remaining 8 items were snails, mussels, barnacles, clams, crabs, polycaete worms, chitons, and sea urchins. River otters preferred larger fish (>15 cm) over smaller fish (<8 cm). In 1996 the most prevalent families of fish found in scat for 8-cm fish were salmons, gunnels, flatfishes, and sticklebacks; for 8–15-cm fish were gunnels, codfishes, sandlances, and sculpins; and for >8-cm fish were flatfishes, sculpins, salmons, and greenlings. We collaborated with researchers at the University of Alaska Fairbanks to analyze river otter scat for DNA microsatellites to estimate river otter density and use of latrine sites by individual animals. We sampled river otter scats among 94 latrine sites in western Prince William Sound for this collaboration.

JOB 4: APPLYING THE LYNX TRACKING HARVEST STRATEGY THROUGH RULE-BASED MODELING

A rule-based model was developed to aid lynx harvest managers in deciding the most appropriate seasons for lynx trapping under the tracking harvest strategy, which applies to the road-connected areas of southcentral Alaska. Details of the model are summarized in the abstract for the paper published from this work, *An expert-system model for lynx management in Alaska*, shown below in section VI.

VI. PUBLICATIONS MANUSCRIPTS:

Golden, H. N. 1999. An expert-system model for lynx management in Alaska. Pages 208–234 in G. Proulx, editor. Mammal trapping. Alpha Wildlife Research and Management Ltd., Sherwood Park, Alberta, Canada.

To provide more responsive management options during the 9–11-year lynx (*Lynx canadensis*) population cycle, lynx managers in Alaska use a tracking harvest strategy (THS). This strategy applies to the road-connected areas of Southcentral and Interior Alaska. It modifies trapping season lengths as lynx and prey populations, mainly snowshoe hares (*Lepus americanus*), vary to ensure that sustainable harvest limits are not exceeded. However, a lack of quantitative population data restricts the ability of managers to make important management decisions. To address this lack of information, I developed an interactive model, called LynxTrak, that uses a rule-based expert-system approach to determine the most appropriate management action to take. This system employs rules that consist of if-then scenarios, culminating in a management goal. LynxTrak uses a knowledge base that incorporates a wide network of quantitative and qualitative information regarding lynx across their range, including available literature, in-house databases, and the collective observations and experiences of field biologists and trappers. The model first calculates the potential of the lynx population in question from information provided by the user. Population potential is a function of lynx abundance, food availability, production, and survival. The estimated optimal yield of the population is based on its potential and estimated size and leads to the calculation of the target harvest index. Harvest pressure is a function of lynx harvest, trapping effort, and the amount of refugia from trapping. The reciprocal of the target harvest index divided by the harvest pressure results in a determination of the risk factor to the lynx population. The risk factor in conjunction with the current lynx season result in a new season recommendation as the final goal in the model. If managers reject the goal presented by the model, it is their responsibility to justify a different course of action. In this paper, I present the basis for the model's structure and mechanics along with a simulation of the model using data from a management area in Southcentral Alaska. A runtime version of the model and documentation are available from the author.

White, K. S., H. N. Golden, Kris J. Hundertmark, and G. R. Lee. In review. Predation by wolves, Canis lupus, on wolverines, Gulo gulo, and an American marten, Martes americana, in Alaska. Canadian Field-Naturalist 000:000–000.

We report here on 3 instances of wolf predation on mustelids in southern Alaska; 2 involving wolverines and another involving an American marten. Such observations are rare but have usually been documented indirectly in previous studies. This account provides insight into the potential role of wolves in influencing mesocarnivore communities in northern environments.

Golden, H. N., B. S. Shults, and K. E. Kunkel In review. Immobilization of wolverines with Telazol® from a helicopter. Wildlife Society Bulletin 000:000–000.

Chemical immobilization of wildlife from a helicopter requires the use of a drug dose that is adequate to sufficiently anesthetize an animal for handling, and a potent but safe drug is preferred. We assessed the efficacy of Telazol® to immobilize free-ranging wolverines (*Gulo gulo*) by darting them with a standard dose of 175 mg from a helicopter in Alaska, 1992–1999. Induction occurred in 3.7 ± 0.3 minutes with no difference between sexes ($\chi^2_1 = 1.35$, $P = 0.245$) despite dimorphism in body mass. Initial sedation was 47.1 ± 9.6 minutes and was usually sufficient for handling, but approximately 1/3 of the wolverines required additional doses of 50–100 mg to maintain sedation. Initial sedation and recovery (95.5 ± 11.2 minutes) were positively related to dosage (mg/kg, $r = 0.76$, $P < 0.004$ and $r = 0.90$, $P < 0.001$, respectively). We consider Telazol to be a highly effective and safe drug for immobilizing wolverines from a helicopter. We recommend projecting it as a standard dose in a small dart at low power to minimize injury and then supplementing as needed to maintain sedation.

Golden, H. N., and K. S. White In Preparation. Wolverine (Gulo gulo) spatial use patterns and habitat selection in the Talkeetna Mountains, Alaska. Journal of Mammalogy 000:000–000.

Golden, H. N., and M. Ben-David. In preparation. Monitoring river otter latrines as an index of population trends: is it a viable tool? Journal of Mammalogy 000:000–000.

VII. RESEARCH EVALUATION AND RECOMMENDATIONS

Details of the elements of study 7.18 that could not be completed, were modified, or should be expanded are evaluated and recommended for further work in the project statement for study 7.19, Furbearer management technique development.

VIII. FEDERAL AID TOTAL PROJECT COSTS FROM BEGINNING TO END OF PROJECT.

$53.4 (FY01) $863.0 (cumulative)

IX. PREPARED BY: APPROVED BY:

Howard N. Golden
Wildlife Biologist III

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Steven R Peterson, Senior Staff Biologist
Division of Wildlife Conservation

SUBMITTED BY:

Donald E.Spalinger
Research Coordinator

____
Wayne L Regelin, Director
Division of Wildlife Conservation

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